

Grasshopper Inventory for Theodore Roosevelt National Park, 2004.

Final Report

By:

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Submitted to:

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Mount Rushmore National Memorial
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Executive Summary

A grasshopper inventory of Theodore Roosevelt National Park was conducted by Gene Kritsky from the College of Mount St. Joseph in Cincinnati, Ohio. The objective of the survey was to compile a species inventory of grasshoppers in the park and surrounding lands by searching relevant literature, examining museum collections, and conducting a physical survey. During the physical survey, which was conducted during late July 2004, various sites that were representative of the types of natural areas found in the park were sampled to assess grasshopper species diversity.

There are 84 species of grasshoppers (Orthoptera: Acrididae) that have been found in North Dakota. Of those 84 species, 54 have been collected in the park and in surrounding Billings and MacKenzie counties. During the summer survey of 2004, we collected or observed 24 species, including one new county record for the park.

Grasshoppers are insects of economic importance as pests of grasslands and grains. Therefore, the United States Department of Agriculture Agricultural Research Service has been actively surveying for grasshoppers in the western states for many years. Their surveys provided this project with a baseline to use in determining the grasshopper diversity of the park. Grasshoppers are herbivorous insects, and their seasonal numbers vary depending upon the amount of rainfall, number of degree-days, and other meteorological factors. These density-independent factors limit the number of species that will be encountered at any one time and place. Generally, grasshopper surveys find approximately 20 species in a given area and season. The results of the 2004 survey indicate that the grasshopper diversity of Theodore Roosevelt National Park is high, with 44.4% of the expected species found during the survey.

THEODORE ROOSEVELT NATIONAL PARK

Abstract

A survey of the grasshoppers (Insecta: Orthoptera: Acrididae) of Theodore Roosevelt National Park was conducted during 2004. The survey included examining literature and museum collections to determine which species had been collected in previous surveys and conducting a physical survey during July 2004. Fifty-four species of grasshoppers are known to occur within the park and adjacent lands. The physical survey found 24 of those 54 species, including one new county record. Voucher specimens of the species collected have been deposited in the museum at the Visitors' Center at the South Unit.

Intro and Methods

Starting in October 2003, the Principal Investigator (PI) began a literature search for prior records of grasshoppers in North Dakota. In addition to published materials, websites were also reviewed to provide a baseline of the grasshopper species known to have occurred in the park and adjacent areas in the past.

In July of 2004, the PI visited North Dakota State University's insect collection to examine specimens from previous surveys. This collection visit was a valuable aspect of this project because insect surveys were conducted on parklands during the 1960s, and staff members have been collecting around the park's perimeter during the past few years.

The survey of the park was conducted from July 20 through July 29, 2004. This period was selected based on degree-day information that predicted we would be likely to encounter grasshoppers commonly found throughout the summer. Grasshoppers are frequently encountered in grasslands and scrub, along rivers and small drainage areas, atop badlands bluffs, and in more open areas, provided that they are surrounded by short vegetation. Theodore Roosevelt National Park abounds in such areas, and we sampled representative locations of the types of terrain found in the park. The sites selected were chosen from the thirty-three collection sites that the PI had established during a survey of tiger beetles conducted during 2001-2003 as representing the diversity of habitat and topography found in the two units of the park. A listing of the locations sampled during this study is provided in Appendix 1. The surveys were conducted using sweep nets to capture grasshoppers for a visual determination of the species. We collected only voucher specimens for each new species and released the duplicates. Surveys started by approximately 9 am and were continued until 8 pm. At one site, the PI and his assistant, Jesse Smith, sampled a transect that extended nearly three miles long. Species-rich sites were revisited during the period of the survey.

Grasshoppers quickly discolor after collection, which required that specimens be curated and identified during the evenings. References used for identification included Pfadt,

R.E. 2002. *Field Guide to Common Western Grasshoppers*, 3rd Edition, Wyoming Agricultural Experiment Station; and Fauske, G. M. 2004, *Orthoptera of the Northern Great Plains*, http://www.ndsu.nodak.edu/entomology/hopper/orthoptera_home.htm.

Results and Discussion

The literature search and museum visit resulted in a baseline of 54 species of grasshoppers in the parklands (Appendix 2). These species represent 64.3% of the grasshoppers known to occur in North Dakota.

The 2004 survey of the park documented 24 species in the park, and they are listed in Appendix 3. These 24 species were observed throughout the park. The mixed grasses occurring in the park, combined with the surrounding grasslands that serve as a grasshopper reservoir, suggest that the 30 species not encountered during the physical survey (Appendix 4) are to be expected within the park if seasonal requirements are met.

Grasshopper surveys taken in rangelands typically find approximately 20 species, with one species being predominant over the others. Our survey found that many species occur throughout the park, and that no one species was predominant. This was expected given that the park is not managed for agricultural use, and the plant diversity and the geographical variation provide a range of habitats to support the diversity of grasshoppers in the park.

One species, *Pardalophora haldemani*, was photographed in the north unit in McKenzie County. Although it was previously known from Billings County, this photographic record represents the first account of the species in McKenzie County. Another species, *Melanoplus brunneri*, has been found on Sentinel Butte (west of the south unit), but has not been seen there in recent years. Although this species is not known from the counties that include the park, its preferred habitat is common in the park, suggesting that it might occur there. It was not found in the 2004 survey, even though areas suitable for the species were sampled. Any future survey should keep an eye out for this rare grasshopper.

Recommendations to Park Management

Theodore Roosevelt National Park shows a high level of grasshopper diversity. Many of the species of the park are cryptically colored, possess variously colored wings and hindlegs, and exhibit interesting behavior that is overlooked by the park's visitors. A PDF/ four-color brochure on the grasshoppers of the park is provided with this report. If made available on the Web for download or provided at the Visitors' Center, it will acquaint the visitor with some of the parks' smaller grazing animals.

There are no endangered or threatened species of grasshoppers within the park; however, *Melanoplus brunneri* may have been extirpated from the state. The park has suitable habitat for this rare species and any future surveys should sample for this species.

Vouchers Collected and Repository

Voucher specimens of 23 species found in the park are to be deposited in the collection at the Visitors' Center at the south unit. Appendix 5 lists the species, how it was collected, and its coordinates.

Appendix 1. Locations surveyed during the 2004 Grasshopper Survey

Site # *	Description of location	gps latitude	gps longitude
TR3	Field behind South Unit's Visitors' Center, and the banks of the Little Missouri River	46° 55.051'N	103° 31.777' W
TR13	First prairie dog town on loop drive in South Unit	46° 55.873'N	103° 30.832' W
TR23	Scrub at base and up to the top of a badlands bluff	46° 55.525'N	103° 31.662' W
TR12	Along banks of Jones Creek	46° 57.974'N	103° 29.231' W
TR18	Grasslands that border Jones Creek	46° 57.974'N	103° 29.231' W
TR 25	Alkali flat and drainage ditch at mile marker 22.5 of loop drive	46° 59.025'N	103° 26.637' W
TR22	Boicourt Overlook	46° 57.427'N	103° 23.855' W
TR19	Western point of the 2.5 mile trail to Petrified Forest – South Unit	46° 59.539'N	103° 36.178' W
TR19	Farthest east of the Petrified Forest Trail sampled	46° 59.915'N	103° 34.918'W
TR8	Juniper Campground along river bank and adjacent field and woodlands – North Unit	47° 35.665'N	103° 20.445' W
TR28	Scrub flats from road to base of bluffs, just east of Long X Pullout – North Unit	47° 36.034'N	103° 20.445' W
TR32	Flat grass scrub across from Bentonitic Clay Overlook – North Unit	46° 55.051'N	103° 31.777' W
TR7	Bluff above Wind Canyon, and in Wind Canyon	46° 59.307'N	103° 29.095' W
TR5	Transect from Peaceful Valley Stables to Little Missouri River	46° 57.580'N	103° 30.261' W

* Site numbers from Tiger Beetle Survey conducted from 2001-2003

Appendix 2. The grasshopper species previously found in the Theodore Roosevelt National Park and adjacent lands.

1. <i>Hesperotettix viridis</i> (Thomas)	Snakeweed grasshopper
2. <i>Aeoloplides turnbulli</i> (Thomas)	Russian-thistle grasshopper
3. <i>Hypochlora alba</i> (Dodge)	Cudweed/ Sage grasshopper
4. <i>Phoetaliotes nebrascensis</i> (Thomas)	Large-headed grasshopper
5. <i>Melanoplus bivittatus</i> (Say)	Two-striped grasshopper
6. <i>Melanoplus differentialis</i> (Thomas)	Differential grasshopper
7. <i>Melanoplus dawsoni</i> (Scudder)	Dawson grasshopper
8. <i>Melanoplus gladstoni</i> Scudder	Gladston grasshopper
9. <i>Melanoplus femurrubrum</i> (DeGeer)	Red-legged grasshopper
10. <i>Melanoplus borealis</i> (Fieber)	Northern grasshopper
11. <i>Melanoplus sanguinipes</i> (Fabricius)	Migratory grasshopper
12. <i>Melanoplus infantilis</i> Scudder	Little spur-throated grasshopper
13. <i>Melanoplus occidentalis</i> (Thomas)	Flabellate grasshopper
14. <i>Melanoplus confusus</i> Scudder	Pasture grasshopper
15. <i>Melanoplus keeleri</i> (Thomas)	Keeler grasshopper
16. <i>Melanoplus foedus</i> Scudder	Federal grasshopper
17. <i>Melanoplus packardii</i> Scudder	Packard grasshopper
18. <i>Melanoplus angustipennis</i> (Dodge)	Narrow-winged grasshopper
19. <i>Melanoplus bowditchi</i> Scudder	Sagebrush grasshopper
20. <i>Mermiria bivittata</i> (Serville)	Two-striped slantfaced grasshopper
21. <i>Pseudopomala brachyptera</i> (Scudder)	Short-winged slantfaced grasshopper
22. <i>Acrolophitus hirtipes</i> (Say)	Green fool grasshopper
23. <i>Chorthippus curtipennis</i> (Harris)	Meadow grasshopper
24. <i>Stenobothrus brunneus</i> (Thomas)	Brunner slant-faced grasshopper
25. <i>Aeropedellus clavatus</i> (Thomas)	Club-horned grasshopper
26. <i>Phlibostroma quadrimaculatus</i> (Thomas)	Four-spotted grasshopper
27. <i>Eritettix simplex</i> (Scudder)	Velvet-striped grasshopper
28. <i>Opeia obscura</i> (Thomas)	Obscure grasshopper
29. <i>Amphitornus coloradus</i> (Thomas)	Striped grasshopper
30. <i>Cordillacris occipitalis</i> (Thomas)	Spotted-winged grasshopper
31. <i>Psoloessa delicatula</i> (Scudder)	Brown-spotted grasshopper
32. <i>Ageneotettix deorum</i> Scudder	White-whiskered grasshopper
33. <i>Aulocara elliotti</i> (Thomas)	Big-headed / Elliott grasshopper
34. <i>Aulocara femoratum</i> (Scudder)	White-crossed grasshopper
35. <i>Boopedon nubilum</i> (Say)	Ebony grasshopper
36. <i>Orphulella speciosa</i> (Scudder)	Showy pasture grasshopper
37. <i>Arphia conspersa</i> Scudder	Speckle-winged grasshopper
38. <i>Arphia pseudonietana</i> (Thomas)	Red-winged grasshopper
39. <i>Encoptolophus costalis</i> Scudder	Dusky/ Western clouded grasshopper
40. <i>Pardalophora haldemani</i> (Scudder)	Haldeman grasshopper
41. <i>Xanthippus corallipes</i> (Haldeman)	Red-shanked grasshopper
42. <i>Hadrotettix trifasciatus</i> (Say)	Three-banded grasshopper
43. <i>Camnula pellucida</i> (Scudder)	Clear-winged grasshopper
44. <i>Spharagemon collare</i> (Scudder)	Mottled sand grasshopper
45. <i>Spharagemon equale</i> (Say)	Orange-legged/Barren-ground grasshopper
46. <i>Dissosteira carolina</i> (Linnaeus)	Carolina locust
47. <i>Trimerotropis agrestis</i> (McNeill)	Toothed slender (field) grasshopper
48. <i>Trimerotropis pistrinaria</i> Saussure	Milk-vetch grasshopper
49. <i>Trimerotropis sparsa</i> (Thomas)	Great basin/ Azure-winged grasshopper
50. <i>Circotettix rabula</i> Rehn & Hebard	Wrangler grasshopper
51. <i>Circotettix carlineanus</i> (Thomas)	Snapper grasshopper
52. <i>Trachyrachys kiowa</i> (Thomas)	Kiowa (range) grasshopper
53. <i>Metator pardalinus</i> (Saussure)	Blue-legged/ Spotted grasshopper
54. <i>Derotmema haydeni</i> (Thomas)	Hayden grasshopper

Appendix 3. Grasshoppers collected in Theodore Roosevelt National Park in 2004.

1. <i>Hesperotettix viridis</i> (Thomas)	Snakeweed grasshopper
2. <i>Melanoplus bivittatus</i> (Say)	Two-striped grasshopper
3. <i>Melanoplus femurrubrum</i> (DeGeer)	Red-legged grasshopper
4. <i>Melanoplus infantilis</i> Scudder	Little spur-throated grasshopper
5. <i>Melanoplus occidentalis</i> (Thomas)	Flabellate grasshopper
6. <i>Melanoplus confusus</i> Scudder	Pasture grasshopper
7. <i>Melanoplus keeleri</i> (Thomas)	Keeler grasshopper
8. <i>Melanoplus packardii</i> Scudder	Packard grasshopper
9. <i>Melanoplus angustipennis</i> (Dodge)	Narrow-winged grasshopper
10. <i>Mermiria bivittata</i> (Serville)	Two-striped slantfaced grasshopper
11. <i>Phlibostroma quadrimaculatus</i> (Thomas)	Four-spotted grasshopper
12. <i>Amphitornus coloradus</i> (Thomas)	Striped grasshopper
13. <i>Cordillacris occipitalis</i> (Thomas)	Spotted-winged grasshopper
14. <i>Ageneotettix deorum</i> Scudder	White-whiskered grasshopper
15. <i>Aulocara ellioti</i> (Thomas)	Big-headed / Elliott grasshopper
16. <i>Pardalophora haldemani</i> (Scudder)	Haldeman grasshopper
17. <i>Spharagemon equale</i> (Say)	Orange-legged/Barren-ground grasshopper
18. <i>Spharagemon collare</i> (Scudder)	Mottled sand grasshopper
19. <i>Dissosteira carolina</i> (Linnaeus)	Carolina locust
20. <i>Trimerotropis agrestis</i> (McNeill)	Toothed slender (field) grasshopper
21. <i>Circotettix rabula</i> Rehn & Hebard	Wrangler grasshopper
22. <i>Trachyrachys kiowa</i> (Thomas)	Kiowa (range) grasshopper
23. <i>Metator pardalinus</i> (Saussure)	Blue-legged/ Spotted grasshopper
24. <i>Derotmema haydeni</i> (Thomas)	Hayden grasshopper

Appendix 4. The grasshopper species not found in the Theodore Roosevelt National Park 2004 survey.

1. <i>Aeoloplides turnbulli</i> (Thomas)	Russian-thistle grasshopper
2. <i>Hypochlora alba</i> (Dodge)	Cudweed/ Sage grasshopper
3. <i>Phoetaliotes nebrascensis</i> (Thomas)	Large-headed grasshopper
4. <i>Melanoplus differentialis</i> (Thomas)	Differential grasshopper
5. <i>Melanoplus dawsoni</i> (Scudder)	Dawson grasshopper
6. <i>Melanoplus gladstoni</i> Scudder	Gladston grasshopper
7. <i>Melanoplus borealis</i> (Fieber)	Northern grasshopper
8. <i>Melanoplus sanguinipes</i> (Fabricius)	Migratory grasshopper
9. <i>Melanoplus foedus</i> Scudder	Federal grasshopper
10. <i>Melanoplus bowditchi</i> Scudder	Sagebrush grasshopper
11. <i>Pseudopomala brachyptera</i> (Scudder)	Short-winged slantfaced grasshopper
12. <i>Acrolophitus hirtipes</i> (Say)	Green fool grasshopper
13. <i>Chorthippus curtipennis</i> (Harris)	Meadow grasshopper
14. <i>Stenobothrus brunneus</i> (Thomas)	Brunner slant-faced grasshopper
15. <i>Aeropedellus clavatus</i> (Thomas)	Club-horned grasshopper
16. <i>Eritettix simplex</i> (Scudder)	Velvet-striped grasshopper
17. <i>Opeia obscura</i> (Thomas)	Obscure grasshopper
18. <i>Psoloessa delicatula</i> (Scudder)	Brown-spotted grasshopper
19. <i>Aulocara femoratum</i> (Scudder)	White-crossed grasshopper
20. <i>Boopedon nubilum</i> (Say)	Ebony grasshopper
21. <i>Orphulella speciosa</i> (Scudder)	Showy pasture grasshopper
22. <i>Arphia conspersa</i> Scudder	Speckle-winged grasshopper
23. <i>Arphia pseudonietana</i> (Thomas)	Red-winged grasshopper
24. <i>Encoptolophus costalis</i> Scudder	Dusky/ Western clouded grasshopper
25. <i>Xanthippus corallipes</i> (Haldeman)	Red-shanked grasshopper
26. <i>Hadrotettix trifasciatus</i> (Say)	Three-banded grasshopper
27. <i>Camnula pellucida</i> (Scudder)	Clear-winged grasshopper
28. <i>Trimerotropis pistrinaria</i> Saussure	Milk-vetch grasshopper
29. <i>Trimerotropis sparsa</i> (Thomas)	Great basin/ Azure-winged grasshopper
30. <i>Circotettix carlineanus</i> (Thomas)	Snapper grasshopper

Appendix 5. Voucher specimen collection information. All specimens collected in Theodore Roosevelt National Park by Gene Kritsky and Jessee Smith, July 20-29, 2004.

Species name	how collected	latitude	longitude
<i>Ageneotettix deorum</i> Scudder	sweeping grass	46° 59.307'N	103° 29.095' W
<i>Ageneotettix deorum</i> Scudder	sweeping grass	46° 57.580'N	103° 30.261' W
<i>Ageneotettix deorum</i> Scudder	sweeping grass	46° 55.873'N	103° 30.832' W
<i>Amphitornus coloradus</i> (Thomas)	sweeping grass	46° 57.427'N	103° 23.855' W
<i>Aulocara ellioti</i> (Thomas)	sweeping grass	46° 59.307'N	103° 29.095' W
<i>Aulocara ellioti</i> (Thomas)	sweeping grass	46° 55.051'N	103° 31.777' W
<i>Circotettix rabula</i> Rehn & Hebard	sweeping grass	46° 55.051'N	103° 31.777' W
<i>Cordillacris occipitalis</i> (Thomas)	sweeping grass	46° 59.307'N	103° 29.095' W
<i>Derotmema haydeni</i> (Thomas)	sweeping grass	46° 59.539'N	103° 36.178' W
<i>Dissosteira carolina</i> (Linnaeus)	sweeping grass	46° 59.025'N	103° 26.637' W
<i>Hesperotettix viridis</i> (Thomas)	sweeping grass	46° 57.974'N	103° 29.231' W
<i>Melanoplus angustipennis</i> (Dodge)	sweeping grass	47° 35.665'N	103° 20.445' W
<i>Melanoplus bivittatus</i> (Say)	sweeping grass	46° 55.051'N	103° 31.777' W
<i>Melanoplus confusus</i> Scudder	sweeping grass	46° 59.307'N	103° 29.095' W
<i>Melanoplus femurrubrum</i> (DeGeer)	sweeping grass	46° 55.051'N	103° 31.777' W
<i>Melanoplus infantilis</i> Scudder	sweeping grass	46° 59.539'N	103° 36.178' W
<i>Melanoplus infantilis</i> Scudder	sweeping grass	46° 59.307'N	103° 29.095' W
<i>Melanoplus keeleri</i> (Thomas)	sweeping grass	46° 57.427'N	103° 23.855' W
<i>Melanoplus occidentalis</i> (Thomas)	sweeping grass	46° 55.525'N	103° 31.662' W
<i>Melanoplus packardii</i> Scudder	sweeping grass	46° 57.580'N	103° 30.261' W
<i>Melanoplus packardii</i> Scudder	sweeping grass	46° 59.307'N	103° 29.095' W
<i>Mermiria bivittata</i> (Serville)	sweeping grass	46° 55.525'N	103° 31.662' W
<i>Metator pardalinus</i> (Saussure)	sweeping grass	46° 57.974'N	103° 29.231' W
<i>Pardalophora haldemani</i> (Scudder)	sweeping grass	46° 55.873'N	103° 30.832' W
<i>Phlibostroma quadrimaculatus</i> (Thomas)	sweeping grass	46° 55.873'N	103° 30.832' W
<i>Phlibostroma quadrimaculatus</i> (Thomas)	sweeping grass	46° 57.974'N	103° 29.231' W
<i>Spharagemon equale</i> (Say)	sweeping grass	46° 57.427'N	103° 23.855' W
<i>Spharagemon equale</i> (Say)	sweeping grass	46° 55.051'N	103° 31.777' W
<i>Spharagemon collare</i> (Scudder)	photographed on trail	46° 59.539'N	103° 36.178' W
<i>Trachyrachys kiowa</i> (Thomas)	sweeping grass	46° 57.974'N	103° 29.231' W
<i>Trimerotropis agrestis</i> (McNeill)	sweeping grass	46° 59.025'N	103° 26.637' W